

CLAIMS

1. A surface treatment agent,

wherein, when a fiber is treated with the surface treatment agent, the treated fiber has following characteristics (1) to (3):

(1) in a soil release test, a numerical value, after cleaning, of soil release rate shown in the following equation is at least 30%,

$$\text{Soil release rate (\%)} = 100 \times (\Delta E_N - \Delta E_{Tn}) / \Delta E_N$$

ΔE_N : Color difference of untreated carpet after soil release test,

ΔE_{Tn} : Color difference of carpet treated with the surface treatment agent after soil release test (n: number of cleaning (n is an integer of 1 to 20));

(2) in a surface analysis of a coating film by an IR-ATR method, a numerical value of a residual rate, after cleaning, of the surface treatment agent shown in the following equation is at least 10%,

$$\text{Residual rate (\%)} = 100 \times (A_2/A_1)$$

A_1 : IR intensity ratio before cleaning,

A_2 : IR intensity ratio after cleaning; and

(3) a Knoop hardness (KH) of the surface treatment agent is at least 5.

2. A surface treatment agent comprising;

(A) a metal alkoxide, and

(B) a polymer comprising

(B-i) a monomer having a carbon-carbon double bond
and a metal alkoxide group,

(B-ii) a fluorine-free (meth)acrylic acid
derivative monomer, and

(B-iii) a fluorine-containing compound having a
functional group reactive with the metal
alkoxide, or

(B-iv) a fluorine-containing monomer having a
carbon-carbon double bond.

3. A surface treatment agent comprising;

(A) a metal alkoxide, and

(C) a copolymer comprising

(C-i) a fluorine-free (meth)acrylic acid derivative
monomer, and

(C-ii) a fluorine-containing monomer having a
carbon-carbon double bond.

4. A surface treatment agent comprising;

(A) a metal alkoxide,

(D) a polymer comprising

(D-i) a fluorine-free (meth)acrylic acid derivative

monomer, and

(E) a fluorine-containing compound having a functional group reactive with the metal alkoxide.

5 5. The treatment agent according to claim 2, 3 or 4, wherein the number of alkoxide groups in the metal alkoxide (A) is from 1 to 12.

10 6. The treatment agent according to claim 2, 3 or 4, wherein a metal in the metal alkoxide (A) is selected from the group consisting of Si, Ti, Al, Zr, Sn and Fe.

15 7. The treatment agent according to claim 2, wherein a metal atom in the monomer having carbon-carbon double bond and metal alkoxide group (B-i) is selected from the group consisting of Si, Ti, Al, Zr, Sn and Fe.

20 8. The treatment agent according to claim 2 or 4, wherein the functional group in the fluorine-containing compound having functional group reactive with metal alkoxide (B-iii) or (E) is a reactive group selected from the group consisting of an alkoxy silane group, a carboxyl group, a hydroxyl group, an epoxy group, a phosphate group, a halogenated silyl group, a sulfonate group, an isocyanate group and a blocked isocyanate group.

9. The treatment agent according to claim 2 or 3, wherein the fluorine-containing monomer having carbon-carbon double bond (B-iv) or (C-ii) is at least one material selected from the group consisting of the group of:

- 5 $\text{CF}_3 (\text{CF}_2)_n (\text{CH}_2)_2 \text{OCOCH}=\text{CH}_2$,
 $(\text{CF}_3)_2 \text{CF} (\text{CF}_2)_n (\text{CH}_2)_2 \text{OCOCH}=\text{CH}_2$, and
 $\text{CF}_3 (\text{CF}_2)_n \text{SO}_2 \text{N} (\text{C}_3 \text{H}_7) (\text{CH}_2)_2 \text{OCOCH}=\text{CH}_2$
wherein n is from 0 to 10.

- 10 10. A coated film formed from the treatment agent according to claim 2 or 3 or 4, wherein the coated film comprises an uneven layer having the whole surface which is roughened by forming microscopic unevenness and a surface roughness of the uneven layer of the coated film is a maximum height (R_{max}) of 0.01 to
15 100 μm .

11. The coated film according to claim 10, wherein a thickness of the coated film is from 0.001 to 100 μm .